

PDP-1 COMPUTER  
ELECTRICAL ENGINEERING DEPARTMENT  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
CAMBRIDGE, MASSACHUSETTS 02139

PDP-21-1

PDP-1 MICROTAPPE HARDWARE

December 21, 1967

The magnetic tape controller can handle 20 (octal) tape transports. Each reel of tape has approximately 1000 blocks of 400 words each. Blocks may be read and written in either direction and in any order without affecting data on other blocks. Each block has a checksum which is automatically written and checked.

The controller can keep any or all transports moving and can monitor end zones and block marks on all units concurrently. It can read, write, and determine actual block numbers on only one unit at a time. Data transfer is through port 4 of the data channel. Words are transferred in core in reverse order when the tape is moving in reverse.

In order to keep a number of operations going simultaneously, the tape controller is wired as three separate IO devices with distinct device numbers.

#### Motion Controller (device number 77)

(all motion control instructions complete immediately)

mot 0 <motion select>

The unit specified by ID 2-5 becomes motion selected. All other motion control instructions apply to the motion selected unit.

mot 100 <skip if ready>

This instruction skips if the motion selected unit is ready (in automatic status).

mot 200 <skip if write OK>

This instruction skips if writing is permitted on the motion selected unit.

mot 300 <skip if end of tape>

This instruction skips if the end of tape indicator for the motion selected unit is on. The indicator is turned on when the tape strikes either end zone, at which time motion automatically stops. The indicator is turned off when the next block mark is found after starting in the other direction.

mot 400 <go>

The motion selected tape is started in the direction specified by the last <forward> or <reverse> instruction.

mot 500 <stop>

The motion selected tape is stopped.

mot 600 <forward>

The tape direction indicator for the motion selected tape is set to forward. It is permissible to change direction while the tape is moving.

mot 700 <reverse>

Similar to <forward>

#### Unit Monitor (device number 20)

unt 100 <unit wait>

This instruction does nothing but wait until one of the following occurs.

Any unit encounters a block mark (enters a block from either direction).

Any unit strikes an end zone.

Any unit becomes ready.

Any unit becomes not ready.

This monitoring function is independent of the data controller.

unt 0 <read unit number>

After a <unit wait> completes, this instruction reads the number of the unit on which the event occurred into IO 2-5 and the type of event into IO 0-1.

IO bit 0 indicates that the tape encountered a block mark or an end mark. <skip if end of tape> will determine which.

IO bit 1 indicates that the unit became ready or not ready. <skip if ready> will determine which.

This instruction completes immediately. Any events that occur while the unit interrupt is not enabled (after one <unit wait> completes but before the next is executed) will remain pending until the next <unit wait>.

#### Data Controller (device number 21)

dat 0 <data select>

The unit specified by IO 2-5 becomes data selected. This instruction completes immediately.

dat 100 <core address>

The core address register is loaded from AC 6-9. Data transfer takes place between C(address register) and C(address register)+377 inclusive. The data transfer area must be on a 400 word boundary. The core module in which the transfer takes place is specified by the core pointer register for data channel port 4. This instruction completes immediately.

dat 400 <search>

The data controller searches for the next block mark on the data selected unit. The instruction completes as soon as the mark is found or an error occurs. If a block mark interrupt is enabled by <unit wait>, that interrupt will occur before the interrupt to signal completion of the <search>. When a <search> completes, it is not possible to read or write the block found by the <search>. A <read> or <write> will use the next block.

dat 500 <read>

The expected block number is taken from AC 6-17, and the data controller searches for the next block mark on the data selected unit. When found, if the block number on the tape matches that given in the AC, the block is read. The instruction completes as soon as the transfer completes or an error occurs.

dat 600 <write>

Similar to <read>.

dat 300 <read status>

The status register, indicating the reason for completion of the last <search>, <read>, or <write>, is read into the IO.

bit 0 (block search done) A <search> has found the next block, or a <read> or <write> found the block but its number did not match the AC. In either case, the actual block number from the tape is in the data buffer register, where it can be read by <read block number>, and the tape is just inside that block. A <read> or <write>, if executed within a reasonable length of time, will find the next block.

bit 1 (data transfer good) A <read> or <write> has completed without error. The tape is just past the end of the block, and the next <read> or <write> will get the second block after the one that was just read or written.

bit 2 (block timing error) A <search>, <read>, or <write> did not find a block mark within 100 ms., or, after finding the block mark, a <read> or <write> did not complete within an additional 100 ms.

bit 3 (end of tape) The tape reached an end zone while a <read>, <write>, or <search> was in progress.

bit 4 (checksum) The checksum was not correct during a <read>. The data transfer took place anyway.

bit 5 (mark track error) The mark track had the wrong information during a <read> or <write>. The operation terminated immediately.

bit 6 (channel timing error) The data channel did not respond in time to a request for a memory cycle. The operation terminated immediately.

bit 7 (write lock) An attempt was made to write on a tape unit on which writing is not permitted.

dat 200 <read block number>

The data buffer register, containing the actual block number on the tape after normal completion of a <search> or an incorrect block number error during a <read> or <write>, is read into the IO. This register is destroyed by <search>, <read>, <write>, or <copy>. This instruction completes immediately.

dat 700 <write time and mark>

This begins the write time and mark (WTM) operation on the data selected unit. The tape must be moving forward and must have both the write permit and WTM permit switches on. No error condition will be given if this is not the case. The writing operation will terminate when 200 microseconds elapse without the execution of a <copy> instruction. The <data select> instruction will have no effect while a WTM operation is in progress. This instruction completes immediately.

dat 1400 <copy>

This transmits data from the AC to be written on the mark and data tracks during a WTM operation. The mark track is written from AC 0-5, and the data tracks are written from the entire AC. <copy> instructions must be given every 200 microseconds while a WTM operation is in progress. Completion of each <copy> is delayed until the controller is ready for the next one, hence, it is impossible to execute <copy's> too rapidly. A program to write time and mark tracks should execute <copy's> in pause mode as rapidly as possible.